NEDERVELD

July 19, 2018

Mr. Jon Coretti
Coretti Law Firm, PLLC
3333 Evergreen NE Suite 200
Grand Rapids MI 49525

RE: Farm Bureau Insurance Company a/s/o New Flevo Dairy, Inc. v CNH America LLC

Dear Mr. Coretti,

This report outlines our findings and opinion regarding the cause of a September 30, 2015 fire involving a 2014 new Holland T8.390 tractor (PIN ZCRC04109) which had accumulated approximately 1,800 hours at the time of the incident. Our investigation has included a review of a fire origin and cause report prepared by Mr. Bill Wilson of Investigative Mechanics which included the examination of an exemplar tractor, an examination of the subject tractor, an examination of a second exemplar tractor, and product research of the New Holland T8 product line.

Factual Information

The New Holland T8 tractor series was first introduced in 2011 as a "Tier 4A" model, referring to the USEPA's non-road Tier 4 emission standards, which were being phased in during that period. As this design was produced through September of 2014, the subject vehicle, and all exemplar vehicles investigated, shared this Tier 4A design. Remarkable aspects of this design include the installation of the selective catalytic reduction (SCR) catalyst on the right side of the vehicle, in front of, and partially surrounded by, the right fuel tank.

A "Tier-4B" version of the T8 tractor was introduced in 2014 and remains in production at the time of this writing. Remarkable aspects of this design include the spatial separation of the fuel tank and SCR catalyst, which results in the catalyst existing above the fuel tank and only surrounded by integrated heat shielding. As such, any accumulated organic debris is apparent to the operator and can be readily evacuated using standard tools and methods.

Review of the US EPA emission standards governing nonroad diesel equipment (40 CFR part 1039) specifies the phase-in requirements for manufacturers to achieve compliance with the applicable standards. As the applicable NOx standard typically requires the addition of substantial exhaust after-treatment systems, including a selective catalytic reduction (SCR) catalyst, a phase-in period was provided for equipment manufactures to accommodate the packaging of this equipment. This phase in period was in largely in effect from 2010 to 2014.

SCR catalysts, and the associated exhaust piping, operate at temperatures that are capable of causing combustion of organic matter consistent with crop debris. As further evidence of this, the "fire prevention" section of New Holland's owner's manual (p 2-5) for the subject vehicle explicitly states:

- Fire risks can be minimized by frequent removal of accumulated crop material, trash or debris from the machine. At least once each day and at the end of the day, remove all trash and debris from the machine especially around hot components such as engine, transmission, exhaust, battery, etc. More frequent cleaning of your machine may be necessary depending on the operating environment and conditions.

In addition, literature published by the Manufacturers of Emission Controls Association (MECA) cites the thermal operating range of temperature of SCR catalysts to be approximately 250 to 450°C (480 to 840°F). As crop debris is a cellulosic material, similar to paper or dry peat, autoignition may be achieved at temperatures as low as 150 to 229°C.

Opinions

The design of the Tier-4A right fuel tank, SCR catalyst, and associated shielding are designed and installed in a manner that does not prohibit organic matter from entering the space surrounding the SCR catalyst. Our observation of the exemplar vehicle at the VanHoff farm, and review of parts diagrams available on New Holland's website, reveals that an approximate 2" air gap is left between the HDPE fuel tank and the SCR catalyst, with a thin foil-faced heat shield affixed to the fuel tank. The fuel tank encompasses four of six sides of the SCR catalyst (rear, right/outboard, left/inboard, and bottom) and the front of the catalyst is covered by a rigid cover panel, which requires the use of hand tools for removal. The left-inboard side of the catalyst is also partially bound by the structure of the tractor, and the top is mainly covered through rigid plastic shielding. However, a large gap exists at the rear termination of the top covering panel, in addition to a 1/2" gap surrounding the vertically installed exhaust pipe; both of which are capable of allowing organic material to enter the spaces below.

Another exemplar vehicle owned and operated by Burnips Equipment was examined by Mr. Wilson, and a written account of the findings and associated photographs were provided for our analysis. During this examination, the front cover of the SCR catalyst was removed, which revealed a substantial accumulation of organic matter at the base of the catalyst (approximately 250 hours on this vehicle vs >1000 on subject vehicle). Furthermore, this organic matter appeared charred where in close proximity to the SCR catalyst. This further substantiates my opinion that the subject design has an increased propensity for crop debris to accumulate and that such debris is in close proximity to high heat sources.

The right fuel tank, SCR catalyst, and associated shielding are not designed and installed in a manner that facilitates the successful evacuation of organic matter surrounding the catalyst using reasonable means or methods. Direct access for an air hose or other cleaning appurtenance is not provided due to the wrap-around nature of the fuel tank design. Additionally, access to the top and front areas is only possible using hand tools (Allen wrench) which is expected to be complicated by mud/debris accumulation in the bolt heads of the attaching fasteners. In contrast, an adjacent, similarly constructed enclosure for the air cleaner utilizes thumb screws for attachment, which is consistent with the expectation that periodic removal, possibly at remote locations, will be necessary for servicing.

The fire involving the subject tractor was caused by organic matter (crop debris) trapped between the SCR catalyst and the right fuel tank. The area of origin has been determined using the witness account of where the fire was first observed, fire patterns on the SCR catalyst, ability of the vehicle to remain operational while the fire progressed, and local wind conditions on the day of the event. Competent ignition sources in this area included radiant or conductive heat transfer from exhaust system surfaces (including the SCR catalyst and related piping) and electrical conductors; the latter of which were eliminated both by visual observation and due to the functionality of the vehicle following the fire discovery. First fuels located in the area of origin included the HDPE fuel tank material as well as organic matter consistent with crop debris. The latter of which was discovered at the time of both Mr. Wilson's investigation as well as our own investigation.

Furthermore, an exemplar vehicle owned and operated by VanHoff Dairy Farm, which was of the same vintage and SCR/fuel tank design, had experienced a similar thermal event involving the same area of origin as the subject vehicle. According to witness accounts provided, smoke, then fire, was first observed in the area of the SCR catalyst and right fuel tank while the vehicle was operating in a field. The owner of the vehicle, Mr. VanHoff, forcefully removed the plastic cover on the front of the SCR catalyst to facilitate extinguishment, by which point the fire was active between the SCR catalyst and fuel tank, causing the HDPE fuel tank to fail. A portable fire extinguisher was brought on site, which allowed the fire to be extinguished prior to full involvement of the vehicle. The owner subsequently removed the damaged fuel tank and observed/photographed fire patterns as well as accumulated organic matter which were discovered between the tank and catalyst. These photographs were provided to us through Mr. Wilson, along with his photographs of the subject area.

As accumulated debris would tend to compact and not have good oxygen exposure, the primary event may have been glowing combustion (smoldering) of the debris, beginning where in contact with the catalyst and/or exhaust componentry. As this glowing combustion spread, the HDPE fuel tank would be subjected to temperatures in excess of 400°F, causing degradation and failure of the tank wall.

The technical feasibility and production practice for manufacturing the 2014 New Holland T8 "Tier 4B" configuration to minimize/remove entrapment areas, provide tool-less access to clear entrapment cavities of field debris, and spatial separation of the SCR catalyst housing from the right side plastic fuel tank were present and available for implementation in the 2011 New Holland T8 "Tier 4A" configuration. The configuration changes from the 2011 New Holland T8 "Tier 4A" positioning of the SCR catalyst housing to the 2014 New Holland T8 "Tier 4B" SCR catalyst housing did not involve any technological innovations or cost prohibitions that were not already available for production of the 2011 T8 "Tier 4A" manufacturing campaign.

Basis of Opinions

Our opinions are based on education, training, and experience along with review and analysis of the resources identified below. A copy of our CVs, including a list of cases for which we have testified by trial and or deposition, is attached. To date, our firm has a total of $2,860.50 for services provided.

Resources

Fire origin and cause report issued by William C. Wilson of Investigative Mechanics, Inc. (dated November 16, 2015).

New Holland Agriculture Genuine Parts Store
(https://partstore.agriculture.newholland.com/us/partssearch.html#epc::mr275198, reference on 9/6/2017)

Operator's Manual for New Holland Agriculture T8 Tractors, Part number 84309497, 1st edition, March 2011.

Manufacturers of Emission Controls Association, "Emission Control Technologies for Diesel-Powered Vehicles," December 2007.

Schaffer, E.L, "Smoldering Initiation in Cellulosics under Prolonged Low-Level Heating." Forest Products Laboratory, Forest Services, U.S. Department of Agriculture, [Fire Technology, February 1980, Volume 16, No. 1].

Babrauskas, V., "Ignition Handbook," Fire Science Publishers, Issaquah, WA, c.2003.

Control of Emissions from New and In-Use Nonroad Compression-Ignition Engines, 40 CFR Part 1039 (69 FR 39213, June 29, 2004 et seq)

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